INTERNAL WORKING DOCUMENT NO. 86-08

Herbicide Site Preparation Trials at Big Brook, 1984

INTRODUCTION

Most herbicide applications in New Brunswick are usually carried out as aerial foliage sprays to release 1 to 3 year old softwood plantations from less desirable hardwood and other brush species. Rarely are these herbicide treatments carried out as a site preparation treatment. Most silviculture foresters in this Province prefer only mechanical site preparation prior to planting. Although this does create a more favorable site for the tree and for planters, it will induce an increase in germination and development of deciduous competition. More than one application of herbicides after these areas are planted is sometimes needed in order to guarantee a free-to-grow environment for the planted stock after 5 years.

Timber Management Branch decided to carry out an experiment using soil applied, persistent herbicides in conjunction with a mechanical site preparation treatment to determine if:

1. these herbicides can reduce the amount of competition coming in during the first 2 years of plantation development.
2. the persistence of these soil applied herbicides will increase the mortality of the planted stock.
3. an increase in height growth of the planted stock can be gained by reducing the competition levels.

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Department of Forests, Mines & Energy
Timber Management Branch

METHODS

Study Area

The study area is located approximately 20 miles north of Fredericton (See Appendix I). Prior to harvesting, the area was classified as a mature HS stand consisting of tolerant hardwoods with a mixture of fir, spruce. The soil is a clay loam with more than 25 cm to bedrock. The area is dry to moist consisting of some wet pockets. General topography is flat to rolling.

The stand was clearcut in 1981 and scarified in October 1982 with sharkfin barrels hauled behind a Clark 880 skidder.

Experimental Design

It was decided, after consultation with the chemical manufacturers to try 11 separate herbicide treatments replicated once. Each block also had a control plot. The treatments, rates and corresponding plot numbers are found in Table 1. Tordon 10K is a pelleted form of herbicide and the rates given for this correspond to Kg of product per ha. All other herbicides were in a liquid form and their rates correspond to litres of product per ha.

Each plot was rectangular in shape (6.10 m x 15.24 m) and each corner marked with yellow stakes. Plots were established 4.57 m from one another to rule out contamination by neighbors through lateral movement of the herbicides in the soil (see Appendix II).

Herbicide Application

The Tordon 10K pellets were applied by means of a modified Seymour Universal (handheld) Spreader on May 17, 1983. All liquid herbicides were pre-mixed with water and applied as a spray solution at 200 litres per ha. The liquid solutions were applied with a hand held pressurized boom sprayer. The Tordon 101, 202 and Hyvar were applied on June 2, while the Velpar and Dyclear were applied on June 3.

Planting Program

On May 7, 1984, one year following herbicide treatments, each plot was planted using three different softwood species. They included white spruce (3-0 bare root), jack pine (paper pot) and black spruce (styroblock). Six trees of each species were planted in 3 rows per plot.

Table 1. The herbicide treatments, rates with corresponding plot numbers used at Big Brook.

Product Name	Common Name	Guarantee	Product Rate	Plot # Block 1	Plot # Block 2
Control				3	16
Velpar L	Hexazinone	240 g/l	16 l/ha	4	12
Hyvar	Bromacil	240 g/l	20 l/ha	5	17
Tordon 10K	Picloram	10%	15 kg/ha	1	15
Tordon 10K	Picloram	10%	30 kg/ha	7	13
Tordon 101	Picloram + 2,4-D	0.06 kg + 0.12 kg/l	5 l/ha	9	18
Tordon 101	Picloram + 2,4-D	0.06 kg + 0.12 kg/l	10 l/ha	2	11
Tordon 202	Picloram + 2,4-D	0.06 kg + 0.20 kg/l	8.3 l/ac	6	14
Tordon 202	Picloram + 2,4-D	0.06 kg + 0.20 kg/l	25 l/ac	8	10
Dyclear 24	Dicamba + 2,4-D	0.2 kg + 0.4 kg/l	5 l/ha	19	24
Dyclear 24	Dicamba + 2,4-D	0.2 kg + 0.4 kg/l	10 l/ha	21	23
Dyclear 24	Dicamba + 2,4-D	0.2 kg + 0.4 kg/l	15 l/ha	20	22

RESULTS

In early July, 1984 each plot was surveyed to assess the effectiveness of each treatment. An ocular estimate of percent cover and average height of every competing species was noted. The percent cover is an estimate of the plot area occupied by a particular species. Also the total height and vigor of the planted stock was determined. This survey was repeated in July 1985.

Vegetative Index

Each competing species found in each plot was recorded as to percent cover and average height. A vegetative index was then computed for each species and then totalled for each plot. Vegetative index is the average height times the percent cover. For instance, if raspberry covered 80 percent of a plot and averaged 0.40 meters in height, it would have a vegetative index (VI) of 0.320 (0.80 x 0.40). If the same plot consisted of 3 other species, each having a VI of 0.120 then the total plot would have a VI of 0.680 (.320 + .120 + .120 + .120). A high VI number indicates heavy competition.

An average VI for each treatment was computed for 1984 and 1985 and is shown in Figure 1.

Planted Stock

While sampling for competing species planted trees were also inspected. Each tree was recorded as either being dead or alive and also the total height of the tree was measured. The percent mortality and average height of each species was computed for each plot.

The average percent mortality of each species from the 1985 survey is shown in Figure 2. Since no mortality was evident in July 1984, only the 1985 results were used.

The average height of each planted species was determined for each plot and then a combined average determined for each treatment for 1984 and 1985. A weighted average percent height increment between 1984 and 1985 was calculated for each species and treatment. The increase for each species per treatment was expressed relative to that for control which, by this process, acquired the base value 0. These results are shown in Figure 3.

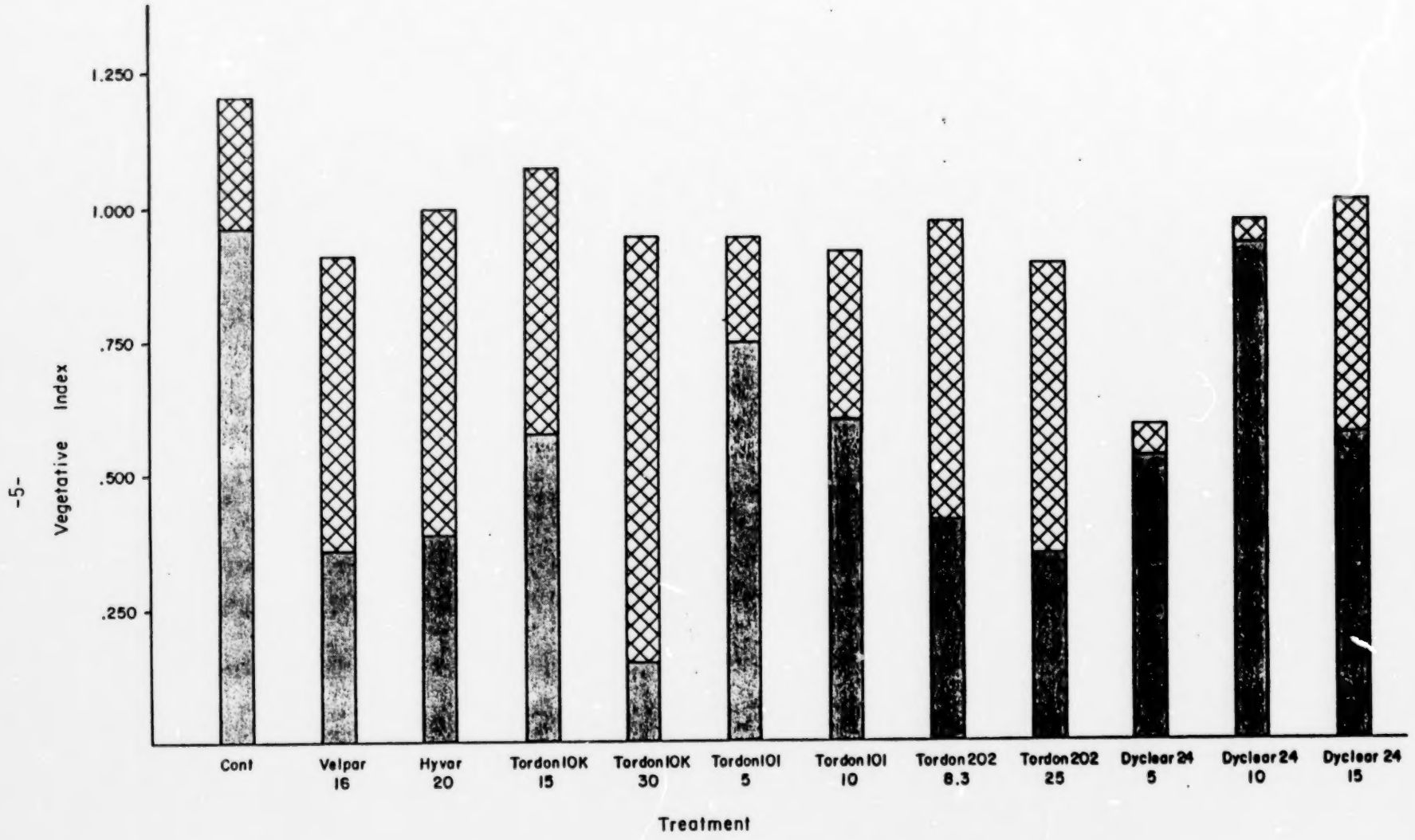


Figure 1. Average vegetative index values for each treatment in 1984 ■ and 1985 ⊠

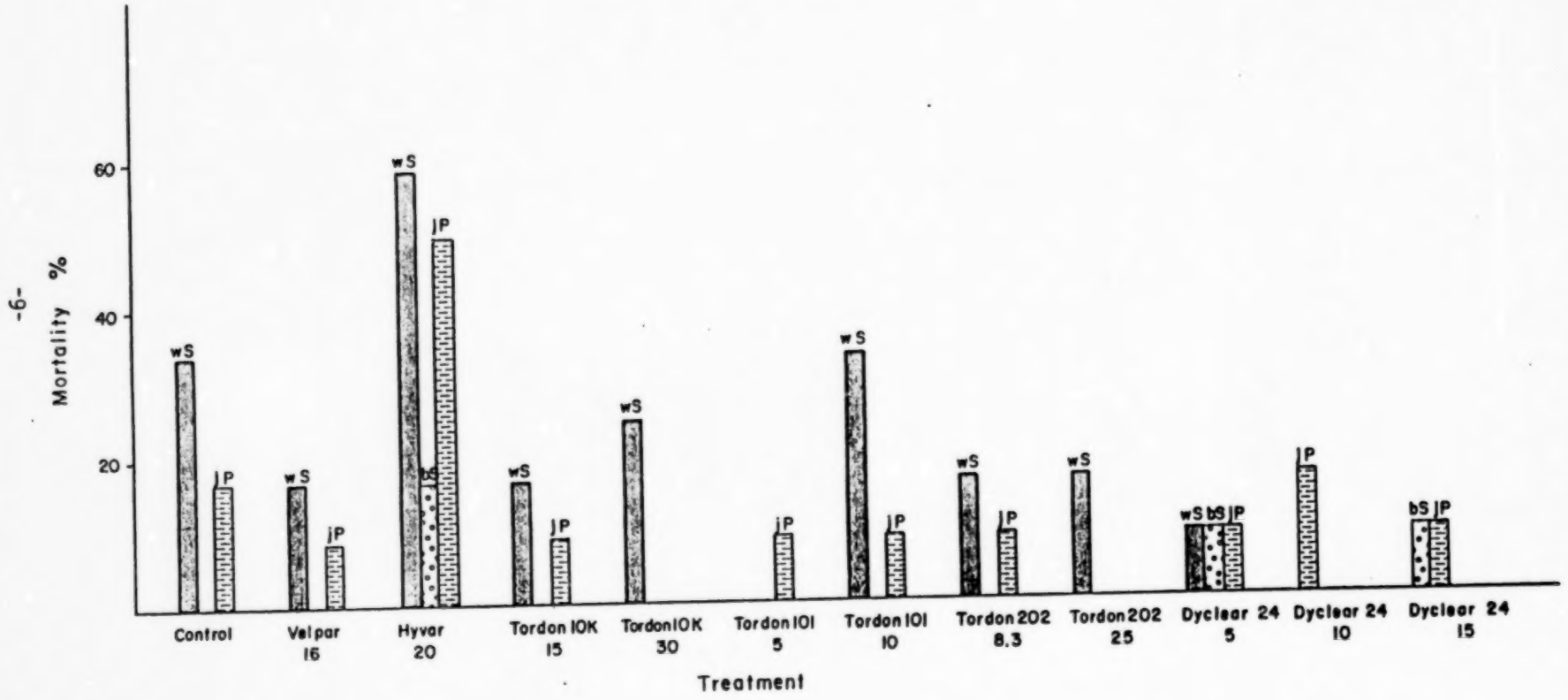


Figure 2. Average percent mortality for each planted species from the 1985 survey.

white spruce
black spruce
jack pine

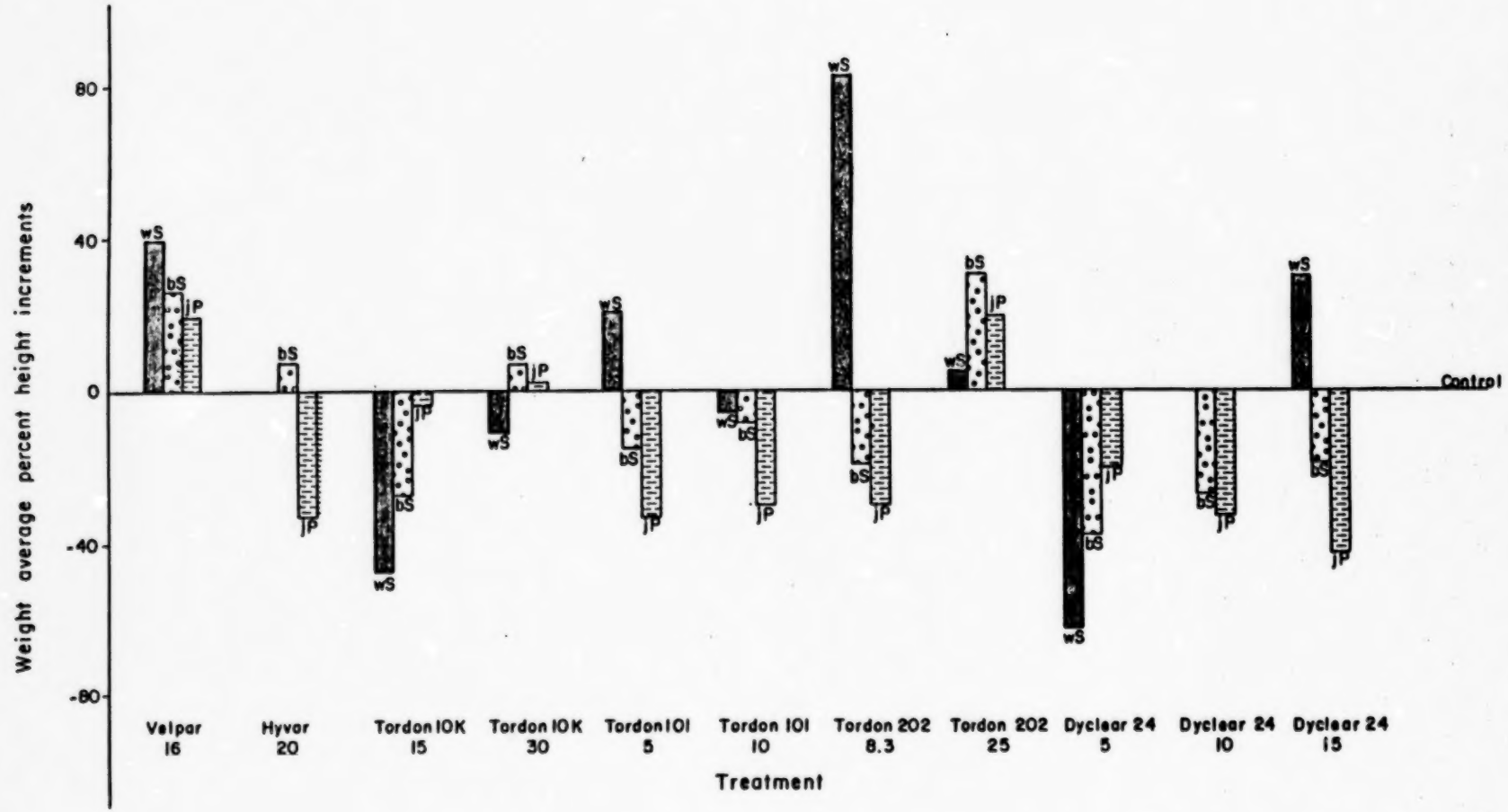


Figure 3. Relative weighted average percent height increments between 1984 and 1985. Control = 0.

white spruce
black spruce
jack pine

Statistical Analysis

Due to the experimental design or lack of it (12 treatments and only 1 replication) statistical analysis was not performed on the vegetative index and the mortality data. An ANOVA was performed on the height data collected in 1985. Duncan's Multiple Range Test was used to determine which treatments showed significant differences. These results can be found in Figure 4.

DISCUSSION

Vegetative Index

Due to the type of mechanical site preparation the previous October and the early date of herbicide application, very little hardwood and brush competition was visible when the herbicides were applied in 1983. Measurements of competing vegetation were not taken until July of 1984, which meant they had time to achieve full leaf and shoot development for that growing season. Therefore, the data collected in the 1984 survey was really a measure of competition development over 2 growing seasons.

The highest VI calculated for both 1984 and 1985 occurred on the control plots, indicating that each herbicide treatment had some effect in vegetation control. Two growing seasons after treatment (July 1984) saw the Tordon 10K @ 30 kg/ha, Velpar, Hyvar and both Tordon 202 treatments have less than one-half the VI value of the control. Available growing space in the crowded control plots limited the amount of new ingrowth. Also competition was so dense, that height increment of existing brush was kept low. Most of the treated plots that had reduced VI values the first 2 years had high VI increases the third year. Between the second and third year, as a result, the residual soil effects of the herbicides had ended and the available growing space was rapidly filled in and utilized by competition.

For treated plots showing high VI values in 1984, there was less of an increase in VI increments in 1985 for the same reasons there were in the control plots, namely, limited growing space.

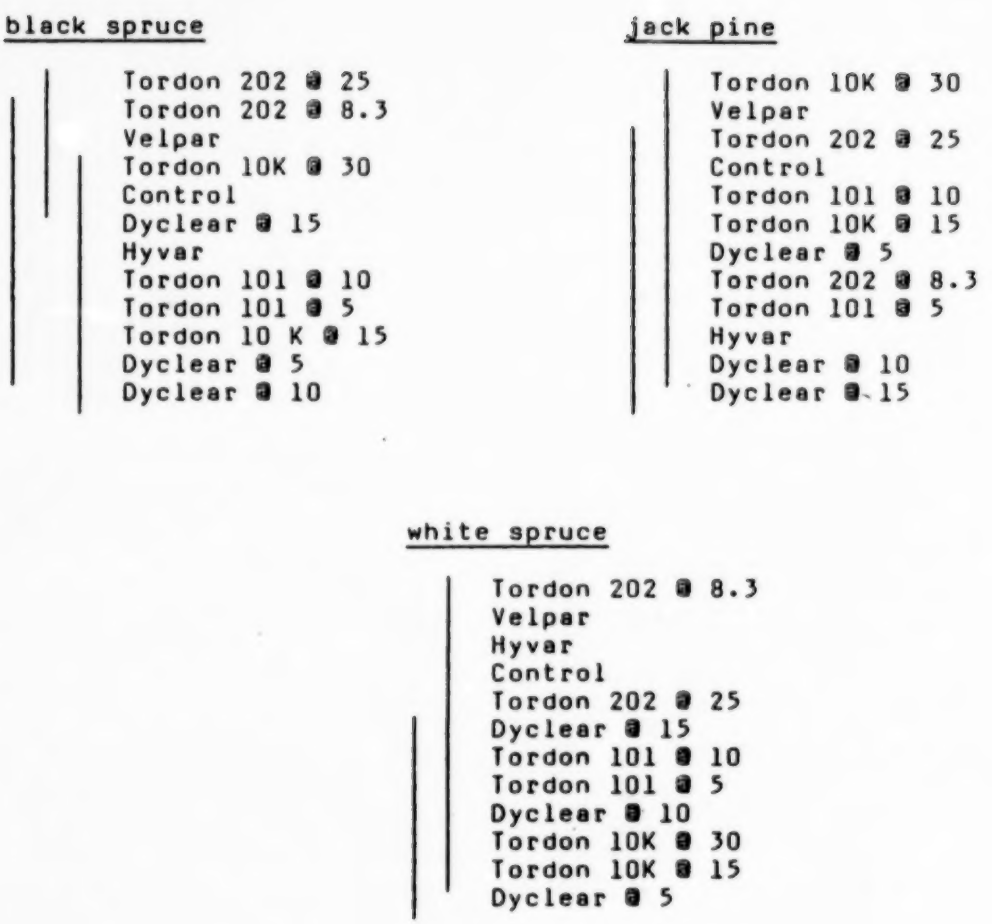


Figure 4. Duncan's multiple range test for 1985 height values. Means connected with the same line are not significantly different.

Mortality

White spruce bare root stock from the Provincial Forest Nursery has a history of low survival percentages during the first two years of outplanting. The control plots showed higher mortality rates for this species than on all treated plots except the Hyvar. Any mortality occurring in the treated plots cannot be therefore totally attributed to chemical effects. Hyvar treated plots had the highest mortality percentages for all three species. Such high mortality rates should rule out any further testing of this herbicide for brush control in conifer plantations.

Black spruce showed the most tolerance of any of the planted species. Only the Hyvar and Dyclear treated plots had mortality and these levels did not exceed 20 percent.

Jack pine has traditionally been one of the most susceptable softwood species to herbicide treatments. Ten of the twelve treatments showed some mortality, including the control plots. This indicates that this species type or at least this batch may be as suspect as the white spruce bare root on sites similar to those at Big Brook. The only two treatments not showing jack pine mortality are Tordon 10K @ 30 and Tordon 202 @ 25. This may be a little misleading however, since mortality was evident when these two herbicides were applied at the lower rates.

Height Growth

Herbicides are used not necessarily to eliminate all brush, but to create an environment where planted softwood trees can thrive - put on maximum height growth. Planted trees usually do not put on good growth until the second or third year of outplanting. The shock of being placed in a new environment will keep tree growth stagnant for one or two years, regardless of moderate brush development or not. This is probably the reason why there was no significant differences in height growth between the control and treated plots.

The Dyclear treatments did result in significant differences in height increments from other treated plots, indicating that this herbicide definitely has a negative effect on height growth.

The Velpar and Tordon 202 @ 25 l/ha were the only treatments where all three planted trees had higher height increments than the control. Both these treatments had some mortality in white spruce and jack pine. However,

no mortality occurred in black spruce. Combine the increase height increment with the brush reduction results and these two treatments seem the best prior to black spruce outplanting. The Tordon 10K @ 30 kg/ha looks to be the third most beneficial treatment and may be the best for jack pine, although at a lower rate this chemical resulted in a small degree of jack pine mortality.

Future Measurements

The area where this trial is located was proposed for treatment by the York License in 1985. Roundup was aerially applied to the entire plantation that year. Therefore, no follow up measurements of the plots can be undertaken.

CONCLUSIONS AND RECOMMENDATIONS

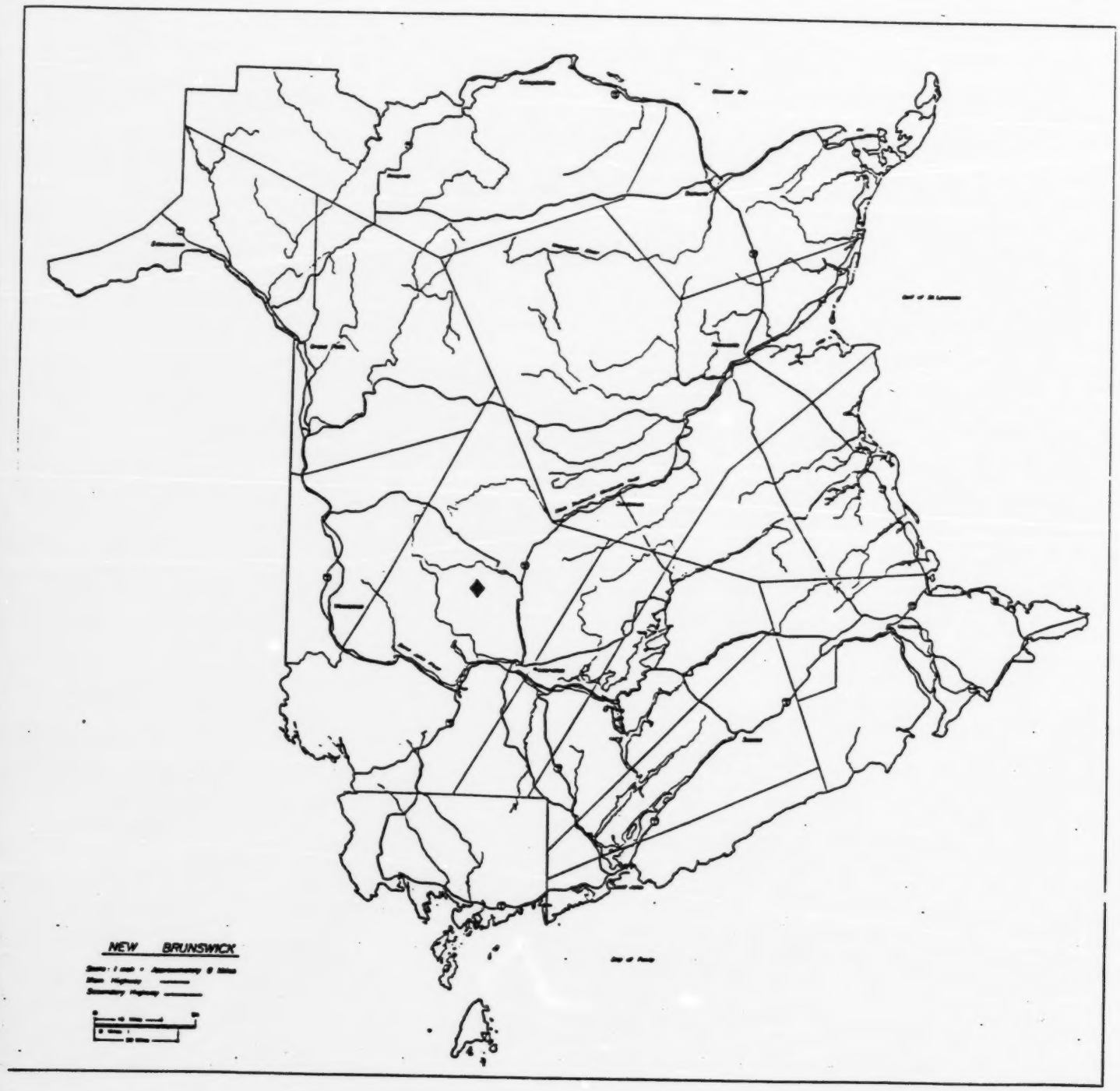
1. Velpar L and Tordon 202 @ 25 l/ha show the most promise for not only brush control (lasting for 2 growing seasons after treatment) but reduced mortality and increase height increments in black spruce plantations.

2. Tordon 10K pellets @ 30 kg/ha, along with the previously mentioned treatments look promising as a site preparation treatment for future jack pine plantations.

3. Chemical site preparation using Velpar L, Tordon 202 and Tordon 10K followed by plantation establishment the year of treatment will be considered.

4. A better statistical design should be employed to obtain more meaningful results. Instead of having one control plot per block, have one for each treatment. (i.e. treat one-half the plot).

APPENDIX I. Map locating chemical site preparation trial at Big Brook.



APPENDIX II. Diagram showing plot locations at Big Brook.